ASME BPVC.VIII.1-2015

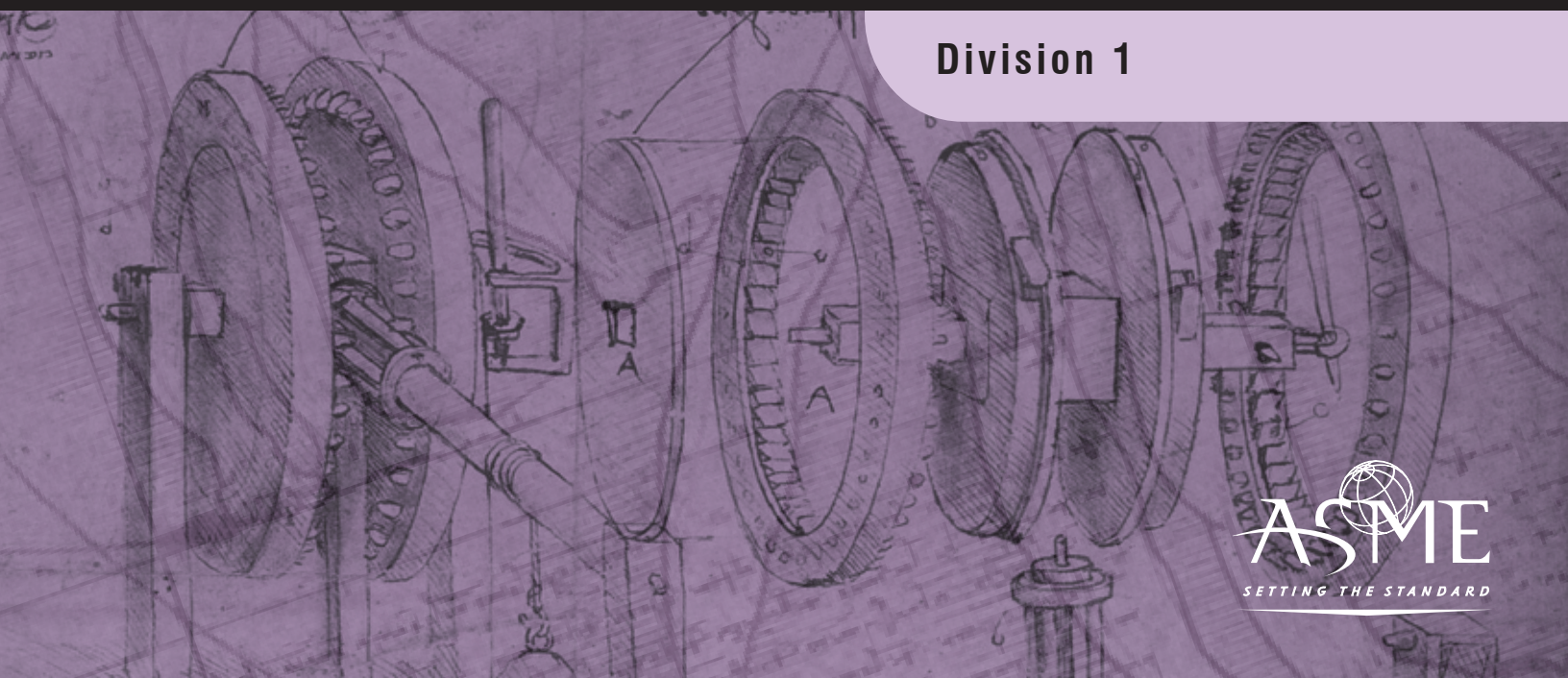
SECTION VIII

Rules for Construction of Pressure Vessels

2015 ASME Boiler and Pressure Vessel Code

An International Code

Division 1



ASME

SETTING THE STANDARD

AN INTERNATIONAL CODE

2015 ASME Boiler & Pressure Vessel Code

2015 Edition July 1, 2015

VIII

RULES FOR CONSTRUCTION OF PRESSURE VESSELS

Division 1

ASME Boiler and Pressure Vessel Committee
on Pressure Vessels

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: July 1, 2015

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[*] The 2015 Edition of Section III is the last edition in which Section III, Division 1, Subsection NH, *Class 1 Components in Elevated Temperature Service*, will be published. The requirements located within Subsection NH have been moved to Section III, Division 5, Subsection HB, Subpart B for the elevated temperature construction of Class A components.

INTERPRETATIONS

Interpretations of the Code have historically been posted in January and July at http://cstools.asme.org/interpretations.cfm. Interpretations issued during the previous two calendar years are included with the publication of the applicable Section of the Code in the 2015 Edition. Interpretations of Section III, Divisions 1 and 2 and Section III Appendices are included with Subsection NCA.

Following the 2015 Edition, interpretations will not be included in editions; they will be issued in real time in ASME's Interpretations Database at http://go.asme.org/Interpretations. Historical BPVC interpretations may also be found in the Database.

CODE CASES

The Boiler and Pressure Vessel Code committees meet regularly to consider proposed additions and revisions to the Code and to formulate Cases to clarify the intent of existing requirements or provide, when the need is urgent, rules for materials or constructions not covered by existing Code rules. Those Cases that have been adopted will appear in the appropriate 2015 Code Cases book: “Boilers and Pressure Vessels” or “Nuclear Components.” Supplements will be sent or made available automatically to the purchasers of the Code Cases books up to the publication of the 2017 Code.

FOREWORD[*]

(15)

In 1911, The American Society of Mechanical Engineers established the Boiler and Pressure Vessel Committee to formulate standard rules for the construction of steam boilers and other pressure vessels. In 2009, the Boiler and Pressure Vessel Committee was superseded by the following committees:

(a) Committee on Power Boilers (I)

(b) Committee on Materials (II)

(c) Committee on Construction of Nuclear Facility Components (III)

(d) Committee on Heating Boilers (IV)

(e) Committee on Nondestructive Examination (V)

(f) Committee on Pressure Vessels (VIII)

(g) Committee on Welding, Brazing, and Fusing (IX)

(h) Committee on Fiber-Reinforced Plastic Pressure Vessels (X)

(i) Committee on Nuclear Inservice Inspection (XI)

(j) Committee on Transport Tanks (XII)

(k) Technical Oversight Management Committee (TOMC)

Where reference is made to "the Committee" in this Foreword, each of these committees is included individually and collectively.

The Committee's function is to establish rules of safety relating only to pressure integrity, which govern the construction[**] of boilers, pressure vessels, transport tanks, and nuclear components, and the inservice inspection of nuclear components and transport tanks. The Committee also interprets these rules when questions arise regarding their intent. The technical consistency of the Sections of the Code and coordination of standards development activities of the Committees is supported and guided by the Technical Oversight Management Committee. This Code does not address other safety issues relating to the construction of boilers, pressure vessels, transport tanks, or nuclear components, or the inservice inspection of nuclear components or transport tanks. Users of the Code should refer to the pertinent codes, standards, laws, regulations, or other relevant documents for safety issues other than those relating to pressure integrity. Except for Sections XI and XII, and with a few other exceptions, the rules do not, of practical necessity, reflect the likelihood and consequences of deterioration in service related to specific service fluids or external operating environments. In formulating the rules, the Committee considers the needs of users, manufacturers, and inspectors of pressure vessels. The objective of the rules is to afford reasonably certain protection of life and property, and to provide a margin for deterioration in service to give a reasonably long, safe period of usefulness. Advancements in design and materials and evidence of experience have been recognized.

This Code contains mandatory requirements, specific prohibitions, and nonmandatory guidance for construction activities and inservice inspection and testing activities. The Code does not address all aspects of these activities and those aspects that are not specifically addressed should not be considered prohibited. The Code is not a handbook and cannot replace education, experience, and the use of engineering judgment. The phrase *engineering judgement* refers to technical judgments made by knowledgeable engineers experienced in the application of the Code. Engineering judgments must be consistent with Code philosophy, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of the Code.

The Committee recognizes that tools and techniques used for design and analysis change as technology progresses and expects engineers to use good judgment in the application of these tools. The designer is responsible for complying with Code rules and demonstrating compliance with Code equations when such equations are mandatory. The Code neither requires nor prohibits the use of computers for the design or analysis of components constructed to the

[*] The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Code.

[**] *Construction*, as used in this Foreword, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and pressure relief.

requirements of the Code. However, designers and engineers using computer programs for design or analysis are cautioned that they are responsible for all technical assumptions inherent in the programs they use and the application of these programs to their design.

The rules established by the Committee are not to be interpreted as approving, recommending, or endorsing any proprietary or specific design, or as limiting in any way the manufacturer's freedom to choose any method of design or any form of construction that conforms to the Code rules.

The Committee meets regularly to consider revisions of the rules, new rules as dictated by technological development, Code Cases, and requests for interpretations. Only the Committee has the authority to provide official interpretations of this Code. Requests for revisions, new rules, Code Cases, or interpretations shall be addressed to the Secretary in writing and shall give full particulars in order to receive consideration and action (see Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees). Proposed revisions to the Code resulting from inquiries will be presented to the Committee for appropriate action. The action of the Committee becomes effective only after confirmation by ballot of the Committee and approval by ASME. Proposed revisions to the Code approved by the Committee are submitted to the American National Standards Institute (ANSI) and published at http://go.asme.org/BPVCPublicReview to invite comments from all interested persons. After public review and final approval by ASME, revisions are published at regular intervals in Editions of the Code.

The Committee does not rule on whether a component shall or shall not be constructed to the provisions of the Code. The scope of each Section has been established to identify the components and parameters considered by the Committee in formulating the Code rules.

Questions or issues regarding compliance of a specific component with the Code rules are to be directed to the ASME Certificate Holder (Manufacturer). Inquiries concerning the interpretation of the Code are to be directed to the Committee. ASME is to be notified should questions arise concerning improper use of an ASME Certification Mark.

When required by context in this Section, the singular shall be interpreted as the plural, and vice versa, and the feminine, masculine, or neuter gender shall be treated as such other gender as appropriate.

STATEMENT OF POLICY ON THE USE OF THE CERTIFICATION MARK AND CODE AUTHORIZATION IN ADVERTISING

ASME has established procedures to authorize qualified organizations to perform various activities in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. It is the aim of the Society to provide recognition of organizations so authorized. An organization holding authorization to perform various activities in accordance with the requirements of the Code may state this capability in its advertising literature.

Organizations that are authorized to use the Certification Mark for marking items or constructions that have been constructed and inspected in compliance with the ASME Boiler and Pressure Vessel Code are issued Certificates of Authorization. It is the aim of the Society to maintain the standing of the Certification Mark for the benefit of the users, the enforcement jurisdictions, and the holders of the Certification Mark who comply with all requirements.

Based on these objectives, the following policy has been established on the usage in advertising of facsimiles of the Certification Mark, Certificates of Authorization, and reference to Code construction. The American Society of Mechanical Engineers does not "approve," "certify," "rate," or "endorse" any item, construction, or activity and there shall be no statements or implications that might so indicate. An organization holding the Certification Mark and/or a Certificate of Authorization may state in advertising literature that items, constructions, or activities "are built (produced or performed) or activities conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code," or "meet the requirements of the ASME Boiler and Pressure Vessel Code." An ASME corporate logo shall not be used by any organization other than ASME.

The Certification Mark shall be used only for stamping and nameplates as specifically provided in the Code. However, facsimiles may be used for the purpose of fostering the use of such construction. Such usage may be by an association or a society, or by a holder of the Certification Mark who may also use the facsimile in advertising to show that clearly specified items will carry the Certification Mark. General usage is permitted only when all of a manufacturer's items are constructed under the rules.

STATEMENT OF POLICY ON THE USE OF ASME MARKING TO IDENTIFY MANUFACTURED ITEMS

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. This includes requirements for materials, design, fabrication, examination, inspection, and stamping. Items constructed in accordance with all of the applicable rules of the Code are identified with the official Certification Mark described in the governing Section of the Code.

Markings such as "ASME," "ASME Standard," or any other marking including "ASME" or the Certification Mark shall not be used on any item that is not constructed in accordance with all of the applicable requirements of the Code.

Items shall not be described on ASME Data Report Forms nor on similar forms referring to ASME that tend to imply that all Code requirements have been met when, in fact, they have not been. Data Report Forms covering items not fully complying with ASME requirements should not refer to ASME or they should clearly identify all exceptions to the ASME requirements.

(15) SUBMITTAL OF TECHNICAL INQUIRIES TO THE BOILER AND PRESSURE VESSEL STANDARDS COMMITTEES

1 INTRODUCTION

(a) The following information provides guidance to Code users for submitting technical inquiries to the committees. See Guideline on the Approval of New Materials Under the ASME Boiler and Pressure Vessel Code in Section II, Parts C and D for additional requirements for requests involving adding new materials to the Code. Technical inquiries include requests for revisions or additions to the Code rules, requests for Code Cases, and requests for Code Interpretations, as described below.

(1) Code Revisions. Code revisions are considered to accommodate technological developments, address administrative requirements, incorporate Code Cases, or to clarify Code intent.

(2) Code Cases. Code Cases represent alternatives or additions to existing Code rules. Code Cases are written as a question and reply, and are usually intended to be incorporated into the Code at a later date. When used, Code Cases prescribe mandatory requirements in the same sense as the text of the Code. However, users are cautioned that not all jurisdictions or owners automatically accept Code Cases. The most common applications for Code Cases are:

(-a) to permit early implementation of an approved Code revision based on an urgent need

(-b) to permit the use of a new material for Code construction

(-c) to gain experience with new materials or alternative rules prior to incorporation directly into the Code

(3) Code Interpretations. Code Interpretations provide clarification of the meaning of existing rules in the Code, and are also presented in question and reply format. Interpretations do not introduce new requirements. In cases where existing Code text does not fully convey the meaning that was intended, and revision of the rules is required to support an interpretation, an Intent Interpretation will be issued and the Code will be revised.

(b) The Code rules, Code Cases, and Code Interpretations established by the committees are not to be considered as approving, recommending, certifying, or endorsing any proprietary or specific design, or as limiting in any way the freedom of manufacturers, constructors, or owners to choose any method of design or any form of construction that conforms to the Code rules.

(c) Inquiries that do not comply with these provisions or that do not provide sufficient information for a committee's full understanding may result in the request being returned to the inquirer with no action.

2 INQUIRY FORMAT

Submittals to a committee shall include:

(a) Purpose. Specify one of the following:

(1) revision of present Code rules

(2) new or additional Code rules

(3) Code Case

(4) Code Interpretation

(b) Background. Provide the information needed for the committee's understanding of the inquiry, being sure to include reference to the applicable Code Section, Division, edition, addenda (if applicable), paragraphs, figures, and tables. Preferably, provide a copy of the specific referenced portions of the Code.

(c) Presentations. The inquirer may desire or be asked to attend a meeting of the committee to make a formal presentation or to answer questions from the committee members with regard to the inquiry. Attendance at a committee meeting shall be at the expense of the inquirer. The inquirer's attendance or lack of attendance at a meeting shall not be a basis for acceptance or rejection of the inquiry by the committee.

3 CODE REVISIONS OR ADDITIONS

Requests for Code revisions or additions shall provide the following:

(a) Proposed Revisions or Additions. For revisions, identify the rules of the Code that require revision and submit a copy of the appropriate rules as they appear in the Code, marked up with the proposed revision. For additions, provide the recommended wording referenced to the existing Code rules.

(b) Statement of Need. Provide a brief explanation of the need for the revision or addition.

(c) Background Information. Provide background information to support the revision or addition, including any data or changes in technology that form the basis for the request that will allow the committee to adequately evaluate the proposed revision or addition. Sketches, tables, figures, and graphs should be submitted as appropriate. When applicable, identify any pertinent paragraph in the Code that would be affected by the revision or addition and identify paragraphs in the Code that reference the paragraphs that are to be revised or added.

4 CODE CASES

Requests for Code Cases shall provide a Statement of Need and Background Information similar to that defined in 3(b) and 3(c), respectively, for Code revisions or additions. The urgency of the Code Case (e.g., project underway or imminent, new procedure, etc.) must be defined and it must be confirmed that the request is in connection with equipment that will bear the Certification Mark, with the exception of Section XI applications. The proposed Code Case should identify the Code Section and Division, and be written as a *Question* and a *Reply* in the same format as existing Code Cases. Requests for Code Cases should also indicate the applicable Code editions and addenda (if applicable) to which the proposed Code Case applies.

5 CODE INTERPRETATIONS

(a) Requests for Code Interpretations shall provide the following:

(1) Inquiry. Provide a condensed and precise question, omitting superfluous background information and, when possible, composed in such a way that a "yes" or a "no" *Reply,* with brief provisos if needed, is acceptable. The question should be technically and editorially correct.

(2) Reply. Provide a proposed *Reply* that will clearly and concisely answer the *Inquiry* question. Preferably, the *Reply* should be "yes" or "no," with brief provisos if needed.

(3) Background Information. Provide any background information that will assist the committee in understanding the proposed *Inquiry* and *Reply.*

(b) Requests for Code Interpretations must be limited to an interpretation of a particular requirement in the Code or a Code Case. The committee cannot consider consulting type requests such as the following:

(1) a review of calculations, design drawings, welding qualifications, or descriptions of equipment or parts to determine compliance with Code requirements;

(2) a request for assistance in performing any Code-prescribed functions relating to, but not limited to, material selection, designs, calculations, fabrication, inspection, pressure testing, or installation;

(3) a request seeking the rationale for Code requirements.

6 SUBMITTALS

Submittals to and responses from the committees shall meet the following:

(a) Submittal. Inquiries from Code users shall be in English and preferably be submitted in typewritten form; however, legible handwritten inquiries will also be considered. They shall include the name, address, telephone number, fax number, and e-mail address, if available, of the inquirer and be mailed to the following address:

Secretary
ASME Boiler and Pressure Vessel Committee
Two Park Avenue
New York, NY 10016-5990

As an alternative, inquiries may be submitted via e-mail to: SecretaryBPV@asme.org or via our online tool at http://go.asme.org/InterpretationRequest.

(b) Response. The Secretary of the appropriate committee shall acknowledge receipt of each properly prepared inquiry and shall provide a written response to the inquirer upon completion of the requested action by the committee.

(15)

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January 1, 2015

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SUMMARY OF CHANGES

After publication of the 2015 Edition, Errata to the BPV Code may be posted on the ASME Web site to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in the BPV Code. Such Errata shall be used on the date posted.

Information regarding Special Notices and Errata is published by ASME at http://go.asme.org/BPVCerrata.

Changes given below are identified on the pages by a margin note, **(15)**, placed next to the affected area.

The Record Numbers listed below are explained in more detail in "List of Changes in Record Number Order" following this Summary of Changes.

Page	*Location*	*Change (Record Number)*
xxv	List of Sections	Revised
xxvii	Foreword	*(1)* Revised *(2)* New footnote added by errata *(13-860)*
xxx	Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees	In last line of 6(a), URL revised
xxxii	Personnel	Updated
2	U-1(g)	*(1)* Paragraph title added *(07-2041)* *(2)* Subparagraph (1) revised *(07-2041)*
3	U-2	Subparagraphs (a)(5), (b)(1), and (e) revised *(12-311, 14-520)*
5	Table U-3	*(1)* References updated *(13-1294)* *(2)* In Note (3), cross-reference to UG-117(f) corrected by errata to UG-117(a) *(13-1750)*
7	UG-4	Subparagraph (d) revised *(12-306)*
10	UG-11	*(1)* In subpara. (b), second sentence revised *(14-451)* *(2)* Subparagraphs (d)(4), (d)(5), and (d)(11)(-d) revised *(13-203, 13-878)*
14	UG-19	*(1)* In subpara. (a), first and second sentences revised *(13-1240)* *(2)* Subparagraphs (a)(2) and (a)(3) titles revised *(13-1240)*
16	UG-23	In the in-text table of subpara. (a), entry for Table UHA-23 revised *(13-1950)*
23	UG-29	In last sentence of Step 2(a), I corrected by errata to I_s *(14-1750)*
27	Figure UG-30	Revised editorially
28	UG-32	*(1)* Subparagraph (b) deleted and subsequent subparagraphs and their cross-references revised editorially *(2)* In subpara. (g), third paragraph, "$\alpha \geq 30$ deg" corrected by errata to "$\alpha \leq 30$ deg" *(14-413)*
33	Figure UG-34	Revised editorially
38	Figure UG-36	Revised editorially
39	UG-37	*(1)* In subpara. (a), definitions of S, t_r, and t_{rn} revised *(13-543)*

Page	*Location*	*Change (Record Number)*
		(2) Subparagraphs (g) and (h) revised *(11-1461)*
42	Figure UG-37.1	Revised editorially
46	Figure UG-40	Revised editorially
48	UG-40(e)	Last sentence added *(08-1506)*
49	Figure UG-41.1	Revised editorially
53	UG-45	*(1)* Definition of t_a revised *(11-441)* *(2)* In definition of t_{UG-45}, in-text Note deleted *(14-1427)*
54	UG-47	In subpara. (a), eq. (2), "p" corrected by errata to "P" *(14-413)*
55	Figure UG-47	Revised editorially
56	UG-53	Subparagraph (j) deleted *(14-1427)*
65	Figure UG-84.1	Revised editorially
66	Figure UG-84.1M	Revised editorially
72	UG-93	In subpara. (d)(3), last sentence deleted *(01-930)*
73	UG-99	In subparas. (e)(1) and (e)(2), paragraph titles added *(13-1240)*
75	UG-100	Subparagraphs (e)(2) and (e)(3) revised *(13-2074)*
81	UG-116	*(1)* Subparagraph (a)(7) added *(07-2041)* *(2)* In the in-text table of subpara. (b)(1), entry for Graphite added *(13-454)*
86	Figure UG-118	*(1)* Figure and numbered Notes revised *(13-63)* *(2)* In General Note, reference to "MAEWP" deleted by errata *(13-1345)* *(3)* In Note (5) [formerly Note (1)], "maximum allowable external working pressure" corrected by errata to "maximum allowable working pressure (external)" *(13-1345)*
88	UG-120(f)	Added, and former subpara. (f) redesignated as subpara. (g) *(07-2041)*
91	UG-129	Subparagraphs (a)(5)(-c) and (e) revised *(09-270, 10-1877)*
95	UG-131(d)(2)	Subparagraphs (-a) and (-b) revised *(10-1877)*
96	UG-131(e)(2)	*(1)* In second paragraph, in-text Note revised *(12-697)* *(2)* In third paragraph, first sentence added and in-text Note deleted *(10-1877)*
100	UG-135	Subparagraph (g) added *(09-270)*
103	UG-136(d)	Subparagraphs (2) and (3) revised *(08-1594)*
105	UG-137(d)(2)	Revised *(08-1594)*
106	UG-138(c)(3)	Revised *(13-1805)*
106	UG-138(d)(2)	Revised *(08-1594)*
107	UG-140	Subparagraph (b)(1) revised *(12-1750)*
110	UW-2(a)(4)	Added *(12-737)*
110	UW-2(c)(4)	Cross-reference to U-1(g) revised to U-1(g)(1) *(07-2041)*

Page	Location	Change (Record Number)
110	UW-2(d)(2)	In last sentence, cross-reference to U-1(g) revised to U-1(h) *(07-2041)*
110	UW-3	Subparagraph (a) revised *(08-29)*
111	UW-5	Subparagraph (b)(2) revised *(14-451)*
113	Figure UW-9	Revised editorially
113	UW-11	*(1)* New subpara. (a)(7) added and subsequent subparagraphs redesignated *(08-29)* *(2)* Subparagraph (e) revised *(13-231)*
114	UW-12	In subparagraph (d), last sentence revised *(11-5)*
115	Table UW-12	General Notes revised *(12-855)*
118	Figure UW-13.1	Revised editorially
121	Figure UW-13.2	Revised editorially
132	Figure UW-16.2	Editorially consolidated into a single-page graphic
134	UW-18	Subparagraph (d) revised *(14-451)*
138	UW-21	*(1)* In subpara. (a), second sentence deleted *(12-11)* *(2)* Subparagraphs (c) and (d) added *(12-11)*
138	Figure UW-21	General Note deleted *(12-11)*
139	UW-27	Subparagraph (a)(4) added *(11-995)*
139	UW-28	In subpara. (d), last sentence, cross-reference to Section IX, QW-201 revised to Section IX, QG-106 *(13-655)*
139	UW-29	In subpara. (e), last sentence, cross-reference to Section IX, QW-201 revised to Section IX, QG-106 *(13-655)*
144	UW-40(c)	Cross-reference to Table UHA-32-6 revised to Table UHA-32-7 *(14-358)*
144	UW-40(f)	Cross-reference to Table UHA-32-6 revised to Table UHA-32-7 *(14-358)*
147	UW-53	Revised *(13-1575)*
154	UB-3	Subparagraph (b) revised *(07-2041)*
156	Figure UB-14	Revised editorially
158	UB-31	In subpara. (d), last sentence, cross-reference to Section IX, QW-201 revised to Section IX, QG-106 *(13-655)*
161	UCS-6	In subparagraph (b)(2), cross-reference to U-1(g) revised to U-1(g)(1) *(07-2041)*
163	Table UCS-23	In subparagraph (a)(2), cross reference to U-1(g) revised to U-1(g)(1) *(07-2041)*
164	UCS-56	In subpara. (c), cross-reference to Table UHA-32-6 revised to Table UHA-32-7 *(14-358)*
168	Table UCS-56-3	General Notes revised *(13-292, 08-39)*
169	Table UCS-56-4	General Note (b)(1)(b) deleted and subsequent Notes redesignated *(08-39)*
165	UCS-66	Subparagraphs (a) and (f) revised *(11-1243, 14-451)*

Page	*Location*	*Change (Record Number)*
176	Figure UCS-66	Note (3)(a) revised *(11-997, 11-1243)*
179	Figure UCS-66M	Note (3)(a) revised *(11-997, 11-1243)*
184	Figure UCS-66.1	Revised editorially
185	Figure UCS-66.1M	Revised editorially
181	UCS-85	In subpara. (e), first sentence revised *(14-610)*
195	Table UNF-23.3	*(1)* Entry for SA-249 added *(10-173)* *(2)* In entries for SB-366, SB-625, SB-673, and B-674, UNS No. N08904 deleted *(10-173, 13-1950)*
198	Table UNF-79	Revised *(06-736)*
204	Table UHA-23	Revised *(07-693, 08-1255, 13-1950, 13-1952, 13-2118, 14-339, 14-358)*
203	UHA-32	Cross-references to Table UHA-32-6 revised to Table UHA-32-7 *(14-358)*
207	Table UHA-32-2	General Note (a) revised *(13-524)*
208	Table UHA-32-4	In General Note, in-text table revised *(07-693, 08-1255, 13-1952)*
209	Table UHA-32-7	Added *(14-358)*
207	UHA-40	Corrected by errata to read ". . . the general requirements for Fabrication in Subsection A, and with the specific requirements for Fabrication in Subsection B" *(14-1750)*
209	UHA-51	Revised *(13-175)*
216	UCI-2	Subparagraph (b) revised *(07-2041)*
221	UCL-11(f)	Added *(12-421)*
225	UCD-2	Subparagraph (b) revised *(07-2041)*
226	Table UCD-23	Revised *(11-1575)*
229	UHT-6	Subparagraph (b)(2) revised *(12-2301)*
244	Figure ULW-17.1	Revised editorially
245	Figure ULW-17.2	Revised editorially
248	Figure ULW-17.4	Revised editorially
254	Figure ULW-22	Revised editorially
259	Figure ULW-54.1	Revised editorially
263	ULT-5	Subparagraphs (f) and (g) revised *(07-712)*
265	Table ULT-23	Revised *(07-712)*
264	ULT-30	Subparagraphs (a) and (d) revised *(07-712)*
267	ULT-56	Subparagraph (c) revised *(07-712)*
267	ULT-57	In subpara. (a), cross-reference to UW-11(a)(7) revised to UW-11(a)(8) *(08-29)*
267	ULT-82	Subparagraph (c) revised *(07-712)*
268	Table ULT-82	Revised *(07-712)*
269	Table ULT-82M	Revised *(07-712)*

Page	*Location*	*Change (Record Number)*
268	ULT-115	In subpara. (a)(2), cross-reference to UG-116(a)(4) added by errata *(13-1750)*
271	UHX-1	Revised *(12-312)*
273	Table UHX-8.1	Revised in its entirety *(13-1386)*
273	UHX-8.2	Definitions of W_{m1c} and W_{m1s} revised *(13-1386)*
274	UHX-10	Subparagraph (h) deleted *(12-312)*
275	UHX-11.3	In definition of r_o, cross-reference to Figure UHX-11.1, sketch (b) corrected by errata to Figure UHX-11.1, sketch (a) *(14-413)*
278	UHX-11.5.1	In subpara. (b), cross-reference to Figure UHX-11.1(d) corrected by errata to Figure UHX-11.1, sketch (d) *(14-413)*
287	UHX-13.3	In nomenclature, P_{sox} replaced by $P_{sox,\max}$ and $P_{sox,\min}$, and P_{tox} replaced by $P_{tox,\max}$ and $P_{tox,\min}$ *(14-1322)*
294	Table UHX-13.4-2	"Operating Pressure" entries revised *(14-1322)*
297	UHX-13.5.9	In subpara. (a)(1)(-b), in the equation for $\sigma_{t,2}$, "$F_{t,\min}$" corrected by errata to "$F_{t,\max}$" *(13-1750)*
301	Table UHX-13.8.4-1	"Operating Pressure" entries revised *(14-1322)*
302	UHX-13.9.3	In subpara. (b)(3), second paragraph, "$\sigma_s - S_{PS,s}$" corrected by errata to "$\sigma_s \le S_{PS,s}$" *(13-1750)*
302	UHX-14.3	In nomenclature, P_{sox} replaced by $P_{sox,\max}$ and $P_{sox,\min}$, and P_{tox} replaced by $P_{tox,\max}$ and $P_{tox,\min}$ *(14-1322)*
309	UHX-14.5.7	In denominator of the equation in subpara. (b), "2" corrected by errata to be superscript *(13-1750)*
312	Table UHX-14.6.4-1	"Operating Pressure" entries revised *(14-1322)*
313	UHX-16	Revised *(12-312)*
313	UHX-17	Revised *(12-312, 13-1386)*
314	Table UHX-17	Revised in its entirety *(13-1386)*
315	UHX-19.3.2	*(1)* Subparagraph (c) revised *(14-997)* *(2)* In subpara. (d), last sentence added *(14-997)*
317	UIG-3	Definition of graphite part added *(13-449)*
318	UIG-23	Revised in its entirety *(13-2108)*
322	Figure UIG-36-1	Revised editorially
334	UIG-116	Subparagraph (b) revised *(13-454)*
335	Form CMQ	Third page revised *(13-453)*
342	Form CCQ	First page revised *(13-455)*
344	Form CPQ	First page revised *(13-455)*
347	1-2	In last part of eq. (3), parentheses corrected by errata to enclose the entire fraction, not just the numerator *(14-258)*
347	1-4	In subpara. (c), last paragraph deleted *(13-1577)*
354	Figure 1-6	Revised editorially

Page	*Location*	*Change (Record Number)*
362	1-10	*(1)* In eq. (27), denominator "21" corrected by errata to "2" *(14-2385)* *(2)* In eq. (31), "t_{eff} = 1" corrected by errata to "$t_{eff} = t$" *(14-258)*
384	2-13(b)	In equation for α_r, "H^2" corrected by errata to "K^2" *(14-258, 14-736)*
388	2-13(c)(1)	In equation for S_{T1}, open parenthesis inserted by errata before "$1.33te_r$" *(14-736)*
389	Table 2-14	In the denominators of the first two "Rigidity Criterion" equations, "$g^2{}_o$" corrected by errata to "$g_o{}^2$" *(14-736)*
401	5-1	Subparagraphs (c) through (f) revised *(12-312)*
409	8-1	Subparagraph (b) revised *(14-372)*
414	Figure 9-5	Revised editorially
418	Figure 9-6	Revised editorially
427	12-1	Subparagraph (b) revised *(14-372)*
438	13-7	In subpara. (a)(1), eq. (1), "PH" corrected by errata to "Ph," and in eq. (2), "Ph" corrected by errata to "PH" *(14-2385)*
444	13-8(h)(4)	In eq. (31), second "=" corrected by errata to "+" *(14-413)*
445	13-9	In subpara. (a), third sentence revised *(13-1240)*
449	13-12	In subpara. (a), third sentence revised *(13-1240)*
452	Figure 13-14(a)	Revised editorially
452	Figure 13-14(b)	Revised editorially
458	14-3(e)(2)	In the denominator of the equation for Z_1, "K_2" corrected by errata to "K^2" *(14-1303, 14-1750)*
461	Figure 17-2	Incorrect figure replaced by errata *(14-1750)*
489	26-1	Revised *(12-312)*
489	26-2	Subparagraph (e) revised *(12-312, 14-1248)*
491	Table 26-2-1	Added *(14-1248)*
489	26-3	*(1)* Definitions of C_3, G_b, L_{dt}, M_z, r_i, θ_z, and τ_z added *(13-359, 13-1279)* *(2)* Definition of r_m revised *(13-1279)*
493	26-4.1	*(1)* Subparagraph (d) revised *(13-359)* *(2)* Subparagraph (f) deleted and subsequent subparagraphs redesignated *(12-312)*
494	26-4.3	Added *(13-359)*
494	26-6.1	Second paragraph revised *(13-1279)*
498	26-6.4.2	In second paragraph, last sentence revised *(14-467)*
499	26-7.1	In second paragraph, first sentence revised *(13-1279)*
501	26-7.3.2	In numerator of equation for S'_1, "E_b" revised to "E_c" *(13-1279)*
501	26-7.4.1	Revised *(13-1279)*
503	26-8.4.1	Last sentence added *(13-1279)*
505	Table 26-8	*(1)* Heading of first column revised *(13-1279)*

Page	*Location*	*Change (Record Number)*
		(2) General Note added *(13-1279)*
508	Table 26-10-1	Variable for "Convolution inside diameter" revised to D_b *(13-1279)*
513	Form 26-1	Revised *(13-359, 13-1279)*
514	Form 26-1M	Revised *(13-359, 13-1279)*
522	Table 31-1	New entry added under "2¼Cr–1Mo" *(11-997)*
541	39-2	*(1)* In subparas. (a) and (b), equations for $k(L)$, "$1/A$" revised to "l/A" *(13-452)* *(2)* In subpara. (b), definition of P, "$p - p_i$" corrected by errata to "$p_a - p_i$" *(14-1303)*
560	Figure A-2	Revised editorially
576	Figure L-1.4-3	Revised editorially
579	Figure L-11-3	Revised *(14-226)*
588	Nonmandatory Appendix R, Introduction	Cross-reference to Table UHA-32-6 revised to Table UHA-32-7 *(14-358)*
590	S-1	Revised *(12-1957)*
594	Form U-1	Item 8 revised editorially
600	Form U-1P	Added *(13-1260)*
602	Form U-2	Items 8 and 20 revised editorially
607	Form U-3	Cross-reference in title and item 8 revised editorially
612	Form U-5	Revised *(14-997)*
613	Table W-3	Column "U-1P" and items (73) through (75) added *(13-1260)*
628	Figure Y-3.2	Revised editorially
630	Figure Y-5.1.1	Revised editorially
630	Figure Y-5.1.2	Revised editorially
631	Figure Y-5.1.3	Revised editorially
631	Y-6.1	In eq. (7), minus sign inserted by errata *(14-736)*
663	Figure JJ-1.2-1	Revised *(13-175)*
664	Figure JJ-1.2-2	In General Note (a), cross-reference to UHA-51(a)(4) revised to UHA-51(a)(3) *(13-175)*
669	Form U-DR-1	Back page revised editorially
671	Form U-DR-2	Back page revised editorially

NOTE: Volume 63 of the Interpretations to Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code follows the last page of Section VIII, Division 1.

LIST OF CHANGES IN RECORD NUMBER ORDER

Record Number	Change
01-930	Deleted last sentence of UG-93(d)(3).
06-736	Added alloys 601, 625, 690, and N06022 to Table UNF-79.
07-693	Added alloy J93380, Grade 6A to SA-995 in Tables UHA-23 and UHA-32-4.
07-712	Revised "Type 304 stainless steel" to "Types 304 and 316 stainless steels" in Part ULT. Added Type 316 to Tables ULT-23, ULT-82, and ULT-82M.
07-2041	Revised U-1(g)(1), UG-116(a), and UG-120(f) to require maximum design steaming capacity be recorded on the nameplate and Data Report for unfired steam boilers.
08-29	Added butt-welded joints in flat tubesheets to UW-3(a). Added new UW-11(a)(7) to address butt welds in a tubesheet. Renumbered the previous UW-11(a)(7) as UW-11(a)(8), and the previous UW-11(a)(8) as UW-11(a)(9). Revised UW-11(a) reference in ULT-57 to account for the changes to UW-11(a).
08-39	Deleted the maximum NPS 4 restriction on the PWHT exemption for circumferential butt welds P-No. 4 and P-No. 5 materials, as shown in General Note (b)(1)(a) in Table UCS-56-3 and General Note (b)(1)(b) in Table UCS-56-4.
08-1255	In Tables UHA-23 and UHA-32-4, incorporated Code Case 2637 for use of S32205. Annulled Code Case 2637 6 months after publication of incorporation.
08-1506	Revised UG-40(e) to clarify that material in tubesheets and flat heads shall not be used for reinforcement of openings in adjacent shells or heads.
08-1594	Revised UG-136(d)(2), UG-137(d)(2), and UG-138(d)(2) to change the subject from "hydrostatic testing" to "pressure testing," revised content to better define the parts exempted from testing, and deleted the word "visible" with regards to acceptance criteria. Deleted the word "visible" from UG-136(d)(3).
09-270	In UG-129(e), added requirements for rupture disks that are fully enclosed in a rupture disk holder or the system it protects from overpressure. In UG-135(g), added requirements for disk marked with lot number only.
10-173	Revised Table UNF-23.3 to reassign UNS N08904 from SB-674 to SA-249.
10-1877	Revised UG-129(a)(5)(-c), UG-129(e)(8)(-c), UG-131(d)(2)(-a), UG-131(d)(2)(-b), and UG-131(e)(2). Deleted in-text note from UG-131(e)(2).
11-5	In UW-12(d), last sentence, added weld joint Type No. 8 to list.
11-441	Modified the definition of t_a in UG-45 to included threading allowance.
11-995	Added UW-27(a)(4) to include hybrid welding.
11-997	Updated Tables UCS-23 and 31-1, and Notes to Figures UCS-66 and UCS-66M with Curve C if material is normalized and tempered.
11-1243	Revised rules in UCS-66(f) to make it clear that toughness testing is mandatory for high-yield (greater than 65 ksi) materials. Added rules to UCS-66(f) to reduce the MDMT determined by impact testing based on coincident ratio. SA-533 Grades B and C, which are currently designated as Curve C materials, were changed specifically to SA-533, Types B and C, Class 1 only in the Notes of Figures UCS-66 and UCS-66M as not all the classes for these two Types are below 65 ksi in yield strength.
11-1461	Revised UG-37(g) to delete the words "to test for tightness of welds that seal off the inside of the vessel." Revised UG-37(h) to clarify that all split re-pads require telltale holes, and deleted "and shall be tested."
11-1575	Revised Part UCD to integrate SA-395 65-45-15.
12-11	Added UW-21(c) and UW-21(d). Deleted General Note from Figure UW-21.
12-306	Revised UG-4(d). The scope of revision includes the use of the word "shall" instead of the word "may."
12-311	In U-2(b)(1) and U-2(e), clarified the Authorized Inspector's responsibility as it relates to design calculations.
12-312	Revised the paragraphs in Part UHX, Mandatory Appendix 5, and Mandatory Appendix 26 that reference U-2(g).

Record Number	Change
12-421	Added UCL-119(f). Interpretation states that the Code requires that welding of cladding material used in design calculations shall be made by a Manufacturer holding a Certificate of Authorization. Code changes require the plate, in this scenario, to have the cladding joints made by a Manufacturer, receive full RT, and be provided with a Partial Data Report and Certification Mark prior to bonding to the base material.
12-697	Changed metric unit for 1,500 psig from 10.9 MPa gage to 10.3 MPa gage in UG-131(e)(2).
12-737	Added UW-2(a)(4) for elements subject to lethal service.
12-855	In Table UW-12, deleted General Note (a), and changed "E = 1.0" to "E = 1.00" in General Note (b).
12-1750	Modified UG-140(b)(1) to allow overpressure by system design in air, water, and steam service for the following: *(a)* where services are critical to preventing the release of fluids that may result in safety or environmental concerns, or *(b)* where failure or premature opening of the pressure relief device would result in an unacceptably high probability of failure or damage to the vessel or other equipment in the system, or *(c)* where failure or premature opening of the pressure relief device would result in significant operational upset(s)
12-1957	In Nonmandatory Appendix S, deleted the hydrostatic test factor and referenced ASME PCC-1 for guidance on bolt torque and troubleshooting flange leakage.
12-2301	Revised UHT-6(b)(2).
13-63	Revised Figure UG-118.
13-175	Revised the lead paragraph in UHA-51. Added new UHA-51(a)(2), and renumbered UHA-51(a)(2), UHA-51(a)(3), and UHA-51(a)(4) as UHA-51(a)(2)(-a), UHA-51(a)(2)(-b), and UHA-51(a)(3), respectively. Deleted "at the MDMT or colder" and added "in accordance with (a)" in UHA-51(f)(4)(-a), UHA-51(f)(4)(-b), and UHA-51(f)(4)(-c). Revised UHA-51(h)(2) to reference UG-84(i). Revised Figures JJ-1.2-1 and JJ-1.2-2 for cross-reference change.
13-203	Revised UG-11(d)(4) to require compliance to Part UB for brazing operations. Revised UG-11(d)(11)(-d) to require written certification to include brazing.
13-231	Modified UW-11(e).
13-292	Deleted SA-202 from Tables UCS-23 and UCS-56-3.
13-359	Added 26-4.3, Torsion.
13-449	In UIG-3, deleted the reference to UIG-3(b) and added the definition of "graphite part."
13-452	In 39-2, the numeral 1 has been changed to lowercase L (l) in the two equations that were incorrect.
13-453	In Form CMQ, the tensile strength values (room temperature and maximum material temperature) have been corrected to match the values in Table UIG-6-1.
13-454	Changed the words "Certification Mark" to "Certification Mark and U Designator" in UIG-116(b).
13-455	Added the "Certified by" line, including the "Date," as it appears on Form CMQ to the Forms CCQ and CPQ.
13-524	Revised General Note (a) in Table UHA-32-2.
13-543	In UG-37(a), revised the definitions of S, t_r, and t_{rn} to require, for nozzles fabricated from welded pipe or tubing, the use of the allowable stress of the corresponding seamless product form, and if there is no corresponding seamless product form, the use of the allowable stress for the welded product form divided by 0.85.
13-655	Revised UW-28, UW-29, and UB-31 to change previous cross-references to Section IX paragraphs to Section IX, QG-106.
13-860	In the Foreword, the subtitle has been deleted and replaced with an ANSI disclaimer as a footnote.
13-878	Revised UG-11(d)(5) to provide an exemption to the requirement for a Material Test Report for non-ASME product standard parts.
13-1240	Revised UG-19 and UG-99 to add the word "dependent" in the description of chambers, and deleted the word "independent" from Mandatory Appendix 13.
13-1260	Added Form U-1P, Manufacturer's Data Report for Plate Heat Exchangers, to Nonmandatory Appendix W.

Record Number	Change
13-1279	In Mandatory Appendix 26, corrected membrane stress due to pressure in collar of reinforced bellows, and made editorial revisions.
13-1294	Revised Table U-3 to update year of acceptable edition for those standards that were reviewed. Corrected standard number for ASNT SNT-TC-1A.
13-1345	Errata correction. See Summary of Changes for details.
13-1386	Updated Table UHX-8.1, nomenclature in UHX-8.2, and UHX-17.
13-1575	Modified UW-53 to provide guidance for ultrasonic examinations performed per UW-51(a)(4).
13-1577	Deleted last sentence and equation in 1-4(c), which corrects an error in the 2013 Edition.
13-1750	Errata correction. See Summary of Changes for details.
13-1805	Revised certification interval in UG-138(c)(3) from 5-yr to 6-yr certification to be consistent with UG-136 and UG-137.
13-1950	Revised UG-23 and Tables UNF-23.3 and UHA-23 to accommodate revision of UNS N08904 from SB (nonferrous) to SA (austenitic stainless steel) specifications.
13-1952	Revised Tables UHA-23 and UHA-32-4 to include UNS S32101 in product forms, plate strips to SA-240, and bar to SA-479.
13-2074	In UG-100(e)(2) and UG-100(e)(3), changed the term “hydrostatic” to “pneumatic.”
13-2108	Completely revised UIG-23.
13-2118	In Table UHA-23, added Alloy UNS 32101 for specifications SA-789, SA-790, and SA-815.
14-226	Revised Caution note in Figure L-11-3 to be consistent with UHX-19.2.2.
14-258	Errata correction. See Summary of Changes for details.
14-339	Added SA-403, N08904 to Table UHA-23.
14-358	Added S31266 to Table UHA-23, added new Table UHA-32-7 to add UNS S31266, and revised UHA-32 table references in UW-40(c), UW-40(f), UCS-56(c), and UHA-32.
14-372	Revised 8-1(b) and 12-1(b).
14-413	Errata correction. See Summary of Changes for details.
14-451	In UG-11(b), changed “Manufacture” to lowercase. In UW-5(b)(2), changed two occurrences of “S-Number” to “P-Number.” In UW-18(d), added “maximum” in two places. In UCS-66(a), re-numbered paragraphs and added metric conversion.
14-467	In 26-6.4.2, changed “materials” to “values” for the origin of the yield strength and provided a more precise cross-reference of the rule to be applied.
14-520	Revised U-2(a)(5).
14-610	In UCS-85(e), corrected the cross-reference to “UG-11(a)” to “UG-11(c) and UG-11(d),” and added the term “nonwelded” after “standard.”
14-736	Errata correction. See Summary of Changes for details.
14-997	Revised UHX-19.3.2(c), UHX-19.3.2(d), and Form U-5.
14-1248	Added Table 26-2-1, with maximum design temperature versus type of material.
14-1303	Errata correction. See Summary of Changes for details.
14-1322	Revised Tables UHX-13.4-2, UHX-13.8.4-1, and UHX-14.6.4-1, operating load cases.
14-1427	Revised UG-45 and UG-53(j) to delete the reference to Nonmandatory Appendix L.
14-1750	Errata correction. See Summary of Changes for details.
14-2385	Errata correction. See Summary of Changes for details.

CROSS-REFERENCING AND STYLISTIC CHANGES IN THE BOILER AND PRESSURE VESSEL CODE

There have been structural and stylistic changes to BPVC, starting with the 2011 Addenda, that should be noted to aid navigating the contents. The following is an overview of the changes:

Subparagraph Breakdowns/Nested Lists Hierarchy

- First-level breakdowns are designated as (a), (b), (c), etc., as in the past.
- Second-level breakdowns are designated as (1), (2), (3), etc., as in the past.
- Third-level breakdowns are now designated as (-a), (-b), (-c), etc.
- Fourth-level breakdowns are now designated as (-1), (-2), (-3), etc.
- Fifth-level breakdowns are now designated as (+a), (+b), (+c), etc.
- Sixth-level breakdowns are now designated as (+1), (+2), etc.

Footnotes

With the exception of those included in the front matter (roman-numbered pages), all footnotes are treated as endnotes. The endnotes are referenced in numeric order and appear at the end of each BPVC section/subsection.

Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees

Submittal of Technical Inquiries to the Boiler and Pressure Vessel Standards Committees has been moved to the front matter. This information now appears in all Boiler Code Sections (except for Code Case books).

Cross-References

It is our intention to establish cross-reference link functionality in the current edition and moving forward. To facilitate this, cross-reference style has changed. Cross-references within a subsection or subarticle will not include the designator/identifier of that subsection/subarticle. Examples follow:

- *(Sub-)Paragraph Cross-References.* The cross-references to subparagraph breakdowns will follow the hierarchy of the designators under which the breakdown appears.
  - If subparagraph (-a) appears in X.1(c)(1) and is referenced in X.1(c)(1), it will be referenced as (-a).
  - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.1(c)(2), it will be referenced as (1)(-a).
  - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.1(e)(1), it will be referenced as (c)(1)(-a).
  - If subparagraph (-a) appears in X.1(c)(1) but is referenced in X.2(c)(2), it will be referenced as X.1(c)(1)(-a).
- *Equation Cross-References.* The cross-references to equations will follow the same logic. For example, if eq. (1) appears in X.1(a)(1) but is referenced in X.1(b), it will be referenced as eq. (a)(1)(1). If eq. (1) appears in X.1(a)(1) but is referenced in a different subsection/subarticle/paragraph, it will be referenced as eq. X.1(a)(1)(1).

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INTRODUCTION

U-1 SCOPE

(a) See below.

(1) The Foreword provides the basis for the rules described in this Division.

(2) For the scope of this Division, pressure vessels are containers for the containment of pressure, either internal or external. This pressure may be obtained from an external source, or by the application of heat from a direct or indirect source, or any combination thereof.

(3) This Division contains mandatory requirements, specific prohibitions, and nonmandatory guidance for pressure vessel materials, design, fabrication, examination, inspection, testing, certification, and pressure relief. The Code does not address all aspects of these activities, and those aspects which are not specifically addressed should not be considered prohibited. Engineering judgment must be consistent with the philosophy of this Division, and such judgments must never be used to overrule mandatory requirements or specific prohibitions of this Division. See also informative and nonmandatory guidance regarding metallurgical phenomena in Appendix A of Section II, Part D.

(b) This Division is divided into three Subsections, Mandatory Appendices, and Nonmandatory Appendices. Subsection A consists of Part UG, covering the general requirements applicable to all pressure vessels. Subsection B covers specific requirements that are applicable to the various methods used in the fabrication of pressure vessels. It consists of Parts UW, UF, and UB dealing with welded, forged, and brazed methods, respectively. Subsection C covers specific requirements applicable to the several classes of materials used in pressure vessel construction. It consists of Parts UCS, UNF, UHA, UCI, UCL, UCD, UHT, ULW, ULT, and Part UIG dealing with carbon and low alloy steels, nonferrous metals, high alloy steels, cast iron, clad and lined material, cast ductile iron, ferritic steels with properties enhanced by heat treatment, layered construction, low temperature materials, and impregnated graphite, respectively. Section II, Part D also contains tables of maximum allowable stress values for these classes of materials, except for impregnated graphite.

The Mandatory Appendices address specific subjects not covered elsewhere in this Division, and their requirements are mandatory when the subject covered is included in construction under this Division. The Nonmandatory Appendices provide information and suggested good practices.

(c) See below.

(1) The scope of this Division has been established to identify the components and parameters considered in formulating the rules given in this Division. Laws or regulations issued by municipality, state, provincial, federal, or other enforcement or regulatory bodies having jurisdiction at the location of an installation establish the mandatory applicability of the Code rules, in whole or in part, within their jurisdiction. Those laws or regulations may require the use of this Division of the Code for vessels or components not considered to be within its Scope. These laws or regulations should be reviewed to determine size or service limitations of the coverage which may be different or more restrictive than those given here.

(2) Based on the Committee's consideration, the following classes of vessels are not included in the scope of this Division; however, any pressure vessel which meets all the applicable requirements of this Division may be stamped with the Certification Mark with the U Designator:

(-a) those within the scope of other Sections;

(-b) fired process tubular heaters;

(-c) pressure containers which are integral parts or components of rotating or reciprocating mechanical devices, such as pumps, compressors, turbines, generators, engines, and hydraulic or pneumatic cylinders where the primary design considerations and/or stresses are derived from the functional requirements of the device;

(-d) structures whose primary function is the transport of fluids from one location to another within a system of which it is an integral part, that is, piping systems;

(-e) piping components, such as pipe, flanges, bolting, gaskets, valves, expansion joints, and fittings, and the pressure containing parts of other components, such as strainers and devices which serve such purposes as mixing, separating, snubbing, distributing, and metering or controlling flow, provided that pressure containing parts of such components are generally recognized as piping components or accessories;

(-f) a vessel for containing water[1] under pressure, including those containing air the compression of which serves only as a cushion, when none of the following limitations are exceeded:

(-1) a design pressure of 300 psi (2 MPa);

(-2) a design temperature of 210°F (99°C);

(-g) a hot water supply storage tank heated by steam or any other indirect means when none of the following limitations is exceeded:

(-1) a heat input of 200,000 Btu/hr (58.6 kW);

(-2) a water temperature of 210°F (99°C);

(-3) a nominal water containing capacity of 120 gal (450 L);

(-h) vessels not exceeding the design pressure (see 3-2), at the top of the vessel, limitations below, with no limitation on size [see UG-28(f), 9-1(c)]:

(-1) vessels having an internal or external pressure not exceeding 15 psi (100 kPa);

(-2) combination units having an internal or external pressure in each chamber not exceeding 15 psi (100 kPa) and differential pressure on the common elements not exceeding 15 psi (100 kPa) [see UG-19(a)];

(-i) vessels having an inside diameter, width, height, or cross section diagonal not exceeding 6 in. (152 mm), with no limitation on length of vessel or pressure;

(-j) pressure vessels for human occupancy.[2]

(d) The rules of this Division have been formulated on the basis of design principles and construction practices applicable to vessels designed for pressures not exceeding 3,000 psi (20 MPa). For pressures above 3,000 psi (20 MPa), deviations from and additions to these rules usually are necessary to meet the requirements of design principles and construction practices for these higher pressures. Only in the event that after having applied these additional design principles and construction practices the vessel still complies with all of the requirements of this Division may it be stamped with the applicable Certification Mark with the Designator.

(e) In relation to the geometry of pressure containing parts, the scope of this Division shall include the following:

(1) where external piping; other pressure vessels including heat exchangers; or mechanical devices, such as pumps, mixers, or compressors, are to be connected to the vessel:

(-a) the welding end connection for the first circumferential joint for welded connections [see UW-13(h)];

(-b) the first threaded joint for screwed connections;

(-c) the face of the first flange for bolted, flanged connections;

(-d) the first sealing surface for proprietary connections or fittings;

(2) where nonpressure parts are welded directly to either the internal or external pressure retaining surface of a pressure vessel, this scope shall include the design, fabrication, testing, and material requirements established for nonpressure part attachments by the applicable paragraphs of this Division;[3]

(3) pressure retaining covers for vessel openings, such as manhole or handhole covers, and bolted covers with their attaching bolting and nuts;

(4) the first sealing surface for proprietary fittings or components for which rules are not provided by this Division, such as gages, instruments, and nonmetallic components.

(f) The scope of the Division includes provisions for pressure relief devices necessary to satisfy the requirements of UG-125 through UG-137 and Mandatory Appendix 11.

(g) Vessels That Generate Steam (15)

(1) Unfired steam boilers shall be constructed in accordance with the rules of Section I or this Division [see UG-120(f), UG-125(b), and UW-2(c)].

(2) The following pressure vessels in which steam is generated shall not be considered as unfired steam boilers, and shall be constructed in accordance with the rules of this Division:

(-a) vessels known as evaporators or heat exchangers;

(-b) vessels in which steam is generated by the use of heat resulting from operation of a processing system containing a number of pressure vessels such as used in the manufacture of chemical and petroleum products;

(-c) vessels in which steam is generated but not withdrawn for external use.

(h) Pressure vessels or parts subject to direct firing from the combustion of fuel (solid, liquid, or gaseous), which are not within the scope of Sections I, III, or IV may be constructed in accordance with the rules of this Division [see UW-2(d)].

(i) Gas fired jacketed steam kettles with jacket operating pressures not exceeding 50 psi (345 kPa) may be constructed in accordance with the rules of this Division (see Mandatory Appendix 19).

(j) Pressure vessels exclusive of those covered in (c), (g), (h), and (i) that are not required by the rules of this Division to be fully radiographed, which are not provided with quick actuating closures (see UG-35), and that do not exceed the following volume and pressure limits may be exempted from inspection by Inspectors, as defined in UG-91, provided that they comply in all other respects with the requirements of this Division:

(1) 5 ft^3 (0.14 m^3) in volume and 250 psi (1.7 MPa) design pressure; or

(2) 3 ft^3 (0.08 m^3) in volume and 350 psi (2.4 MPa) design pressure;

(3) $1\frac{1}{2}$ ft^3 (0.04 m^3) in volume and 600 psi (4.1 MPa) design pressure.

In an assembly of vessels, the limitations in (1) through (3) above apply to each vessel and not the assembly as a whole. Straight line interpolation for intermediate volumes and design pressures is permitted. Vessels fabricated in accordance with this rule shall be marked with the "UM" Symbol in Figure UG-116 sketch (b) and with the data required in UG-116. Certificates of Compliance shall satisfy the requirements of UG-120(a).